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**HARMFUL AND BENEFICIAL MAMMALS
OF THE ARID INTERIOR,**

WITH SPECIAL REFERENCE TO THE CARSON AND
HUMBOLDT VALLEYS, NEVADA.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BIOLOGICAL SURVEY,

Washington, D. C., July 25, 1908.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin a report on the Harmful and Beneficial Mammals of the Arid Interior, more particularly those of the Carson and Humboldt valleys, Nevada. Large tracts of arid desert are now being reclaimed and converted into arable land, rich in agricultural possibilities. Crops, trees, live stock, poultry, and ditch banks in this reclaimed territory suffer from the depredations of certain mammals, and the farmers, many of whom are from remote localities, are not always able to discriminate between friends and foes; nor are they always acquainted with cheap and effective methods of destroying the noxious kinds.

The report comprises a brief account of the commoner mammals of the region, with special reference to their economic status and the best means of destroying the noxious species, and has been prepared as a practical aid to the ranchmen of the arid interior.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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HARMFUL AND BENEFICIAL MAMMALS OF THE ARID INTERIOR, WITH SPECIAL REFERENCE TO THE CARSON AND HUMBOLDT VALLEYS, NEVADA.

INTRODUCTION.

The great arid valley surrounding the sinks of the Carson and Humboldt rivers in western Nevada is being reclaimed and converted into a rich agricultural area, and its population is rapidly increasing. The settlers who are bringing these lands under cultivation are confronted with various problems connected with the present and prospective relations of the native mammals to agriculture. Farm crops, trees, live stock, poultry, and ditch banks suffer from the depredations of certain species, and in the indiscriminate retaliation that follows the beneficial animals often suffer equally with the injurious. To many of the settlers who have come from remote localities the mammals are strange and their habits unknown.

At the request of the Reclamation Service and some of the resident farmers, the Biological Survey has undertaken to prepare a brief account of such of the common species of the region as are of importance to agriculture, whether beneficial or detrimental, to the end that the farmers may know friends from foes. As will be seen, most of the losses inflicted by the noxious species may be materially lessened, if not altogether prevented.

The rainfall in this region is extremely limited, but an abundance of pure water is brought from the mountains through great canals, which feed thousands of smaller canals and ditches, extending in an elaborate network among the farms. Many of the ditches are above the general level, and when they are tapped by the burrows of small rodents the water escapes and quickly cuts out the banks. At first the breaks along the canals and ditches were so frequent and serious that a daily patrol was required to avoid expensive repairs. Moreover, as farms are opened up and fields planted, many of the crops and trees are injured by rodents, while poultry, if unprotected, is in danger from nocturnal prowlers. On the other hand, a number of birds and mammals prey almost exclusively on some of the most injurious rodents and insects.

The principal harmful mammals are pocket gophers, meadow mice, ground squirrels, chipmunks, muskrats, kangaroo rats, white-footed

mice, harvest mice, house mice, pocket mice, and several species of rabbits. Sometimes coyotes, foxes, and bobcats are very destructive and sometimes very beneficial. The mainly beneficial mammals are badgers, weasels, common skunks, little spotted skunks, grasshopper mice, and several species of bats.

While only those mammals common in the Carson Sink and Humboldt valleys are treated in detail in the present account, most of these species inhabit also other valleys of Nevada, western Utah, southern Idaho, and southwestern Oregon, or nearly the entire sagebrush valley region of the Great Basin. A brief description and an account of the habits of each species is given, with recommendations for the destruction of the injurious and the protection of the beneficial.

GROUND SQUIRRELS.

About a dozen species of small ground squirrels inhabit the arid interior of the western United States, and one or another is found in almost every valley. In many of the irrigated and fertile valleys they do serious injury to crops, and sometimes their burrows are a menace to banks of irrigation ditches. In the aggregate the annual losses to farmers and fruit growers in the United States from the depredations of ground squirrels have been estimated at \$10,000,000.

The habits of the small desert species are very similar, and the following directions for the destruction of the Piute ground squirrel apply equally well to most of them.

PIUTE GROUND SQUIRREL.

(*Citellus mollis.*)

These short-tailed, plump little ground squirrels are plain gray without distinctive markings. They are about $6\frac{1}{2}$ inches long to the tail, which adds $1\frac{1}{2}$ inches to the length. They range over much of the valley country of Nevada, western Utah, southern Idaho, and eastern Oregon, at times becoming extremely numerous in certain valleys and causing great damage to crops. They burrow in the fields and meadows, where their shrill little whistle is often heard. In late summer or early fall they become very fat and retire to their burrows to hibernate, not reappearing until early spring. They feed not only on seeds, including grain, but very extensively on green vegetation, and show a partiality for such crops as alfalfa, clover, and many garden vegetables. They also eat insects to a limited extent. When present in their usual numbers they are of little consequence, but occasionally they become so excessively numerous as to destroy almost the whole crop in one or several valleys. It is not difficult to shoot, trap, or poison them over a limited area, but when the area infested is exten-

sive, the work of destroying them means a heavy expense. At certain seasons they are readily killed by scattering poisoned grain among their burrows, but when green vegetation is abundant they do not care for dry grain, and some other method of poisoning must be employed. At such times it is probable that they can be destroyed by means of poisoned alfalfa, melon rinds, turnips, beets, green corn, or other vegetable, or with fresh meat (as they greedily devour each other when caught in traps); but further tests must be made before positive recommendations can be given. Their burrows are usually single and not very extensive, and the animals are readily killed by pouring a tablespoonful of bisulphide of carbon on a ball of dry horse manure or other absorbent, rolling it down the burrow and closing the entrance. A pailful of water poured into the burrow will usually bring out the occupant choking and dazed, when it may be easily caught or killed. In this way Indian boys secure great numbers for food. The animals are really tender and delicious, more delicate than

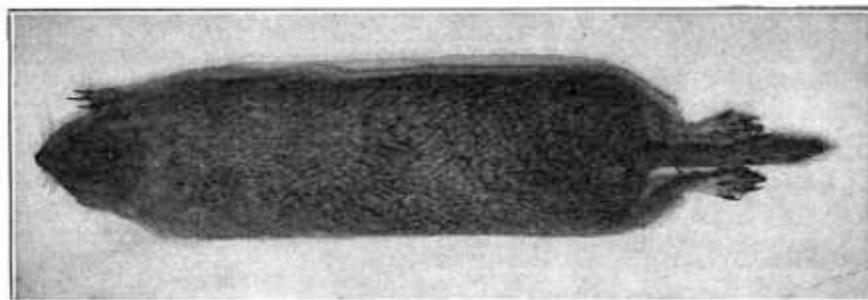


FIG. 1.—Piute ground squirrel (one-half life size).

any of the tree squirrels, and equally well flavored. Their habits are cleanly, and there is no valid objection except their small size, to their use as food.

Directions for poisoning.—For poisoning these and other ground squirrels, chipmunks, rats, and mice the following preparation is recommended by S. E. Piper, after numerous tests in the field:

Dissolve one ounce of strychnia sulphate and 2 ounces of borax in 2 quarts of hot water in a closed vessel, stirring occasionally for twenty minutes, or until completely dissolved. Then add 6 quarts of warm water, and sprinkle this poisoned solution over 30 pounds of rolled or crushed wheat, stirring and mixing thoroughly until it is all absorbed. Place a quarter of a teaspoonful of the poisoned grain near the entrance of each occupied burrow, or in each runway. For mice half an ounce of strychnine is sufficient.

Green alfalfa poisoned with strychnine has given the most satisfactory results in field experiments made by S. E. Piper on this and other ground squirrels. It may be prepared as follows: Dissolve 1

ounce of strychnia sulphate in 1 gallon of hot water. Sprinkle this, when cool, over 35 pounds of freshly cut young alfalfa. Young shoots 3 to 5 inches long are the best, but larger plants may be chopped to the required size. Mix and stir until the liquid is absorbed. Scatter the poisoned alfalfa among the burrows and on the feeding grounds of the squirrels at evening, to be eaten early in the morning before it is withered by the sun. Directions for the preparation of strychnine and chopped alfalfa hay are given on page 12.

ANTELOPE SQUIRREL.

(*Ammospermophilus leucurus.*)

The antelope squirrel is a little larger and stouter than the chipmunk, and unmistakably marked by the short, wide tail, curled over the rump so as to show the white undersurface to the greatest advantage. By means of this conspicuous flag and the dull white stripes along the side of the plain brownish back, together with the

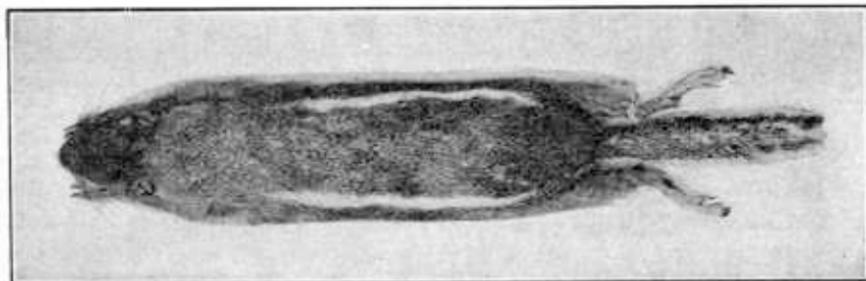


FIG. 2.—Antelope squirrel (one-half life size).

short ears and compact form, the little animals are easily recognized even at a distance.

They are characteristic desert dwellers, living mainly on the ground and digging numerous burrows under the bushes and in convenient banks. When seen they are usually running rapidly to take refuge in these burrows or to escape among the bushes. Occasionally one climbs to the top of a sage bush and sits straight up to get a wider view or to bask in the warmth of the morning sun. Their note of alarm or warning is a shrill chatter, but this is rarely heard. Like the chipmunks and other ground squirrels, they are entirely diurnal, and enter their burrows for the night soon after sunset. Fortunately they are not usually numerous and, except rarely when they gather along the edges of fields and feed on grain, do little harm to farm crops. They are fond of many kinds of grain and seeds, and also feed to some extent upon insects. In the ditch banks, however, they are likely to prove serious pests, as they are especially fond of burrowing into any slightly elevated ground. Their burrows are frequently

extensive, often going in one side of a ditch bank and coming out the other, near or even below the water line. Fortunately they are easily destroyed by shooting, trapping, or poisoning. It is necessary only to scatter a little poisoned grain near their burrows or along banks and under the bushes where they run to effectually reduce their numbers. For preparing poisoned grain, see page 7.

CHIPMUNKS.

Most of the chipmunks of the western United States inhabit mountain or forest country, but a few of the smaller species abound in the open valleys, especially where sagebrush affords protecting cover. In some of the National Forests they have proved a great nuisance by digging up and eating planted seeds of sugar pines and other conifers. When they gather in sufficient numbers about ranches and along the edges of fields, they often dig up the newly planted or sprouting seeds, and later make serious inroads on the ripening grain. In such cases, they are readily destroyed by scattering poisoned grain along their runways or on their feeding grounds. Directions for the preparation of poisoned grain are given on page 7.

SAGEBRUSH CHIPMUNK.

(*Eutamias pictus*.)

These, the smallest and sprightliest of all our chipmunks, inhabit the valleys, where they are readily distinguished from the ground

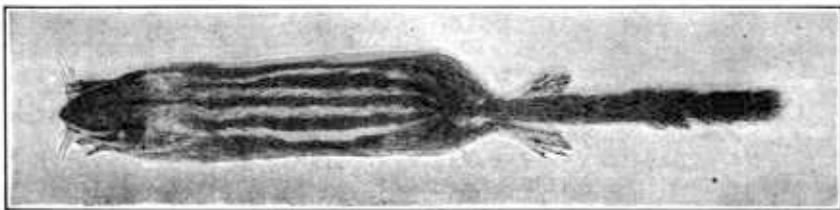


FIG. 3.—Sagebrush chipmunk (one-half life size).

squirrels by their sharp ears, long slender tails, and striped backs, there being five dark and four light stripes along the back. The length from tip of nose to base of tail is about $4\frac{1}{2}$ inches. The tail is about $3\frac{1}{2}$ inches long.

They live mainly in the sagebrush, climbing rapidly through the branches of these diminutive tree-like bushes, as the large chipmunks do through the branches of real trees, or scampering across bare sandy spaces from one bush to another. They often sit on sagebrush tops, eating the little seeds, which they hold in their hands. Their food consists in small part of insects, especially the tiny caterpillars that infest the sagebrush, but is mainly the seeds of sagebrush and numerous small plants that abound on the desert. All cultivated grains are

eaten, and in places where great numbers of chipmunks gather along the edge of a field they seriously damage growing crops of wheat, oats, and barley. Except rarely and on limited areas their depredations need not be feared, however, and it is a simple matter to reduce their numbers sufficiently by scattering poisoned grain along the fences or edges of fields where they congregate. They live in burrows in the ground, which they either dig for themselves or appropriate from other more industrious animals, but are not extensive burrowers, and are not likely to interfere seriously with ditch banks. They do not hibernate, but are active throughout the year, and are constantly preyed upon by hawks, owls, and small carnivores.

MEADOW MICE.

Many species of meadow mice inhabit the meadows and stream banks of the western mountain slopes; others, the moist land in the valleys; while still others choose dry fields or arid sagebrush mesas. In habits the various species differ widely, but those that occupy agricultural land are sure to damage crops, and where sufficiently numerous, they become one of the most serious of mammal pests. A recent study of a destructive plague in Humboldt Valley has thrown much light on the practical methods available in dealing with these rodents, and the methods recommended for their destruction will apply to most species of meadow mice.

CARSON MEADOW MOUSE.^a

(*Microtus montanus.*)

The Carson meadow mouse, black meadow mouse, field mouse, or bear mouse is a stout little animal about 5 inches long to the tail, which is about 2 inches. The short ears are almost hidden in the long, fluffy fur, and the whole color often gives the effect of dull black. Upon close examination the upper parts are found to be dark brownish or grayish and the under parts and feet a lighter shade of gray.

These little animals inhabit naturally the marshes and tule borders of the lakes and streams, but as fast as the country settles up push their way into meadows and fields. They make their homes in the ground wherever a supply of food is found, and are particularly fond of burrowing into the banks of ditches. They take to the water readily, are good swimmers and divers, and therefore can not be drowned out of irrigated fields, as many other small rodents can. Flooding their burrows causes them only temporary inconvenience, as they readily swim to the nearest cover and return as soon as the water disappears. They build warm nests of grass under the cover

^a A report on these mice, with full directions for their destruction, by S. E. Piper, of the Biological Survey, is about to be published.

of fallen vegetation or in underground burrows, where the young are produced and raised in comparative safety. They are very prolific, breeding several times a year and raising litters of 5 to 8 young. Their food consists mainly of green vegetation, of which alfalfa and clovers are preferred to all else. They eat all kinds of grain and seeds or growing vegetables, and are especially fond of potatoes, beets, and other root crops, which they reach by burrowing along the row from one plant to another. Under normal conditions, when living on wild grasses and plants and preyed upon by a host of enemies, these mice do comparatively little damage. Under other circumstances, however, with few enemies and an abundance of rich food, as alfalfa and cultivated crops, and under the protection of dense vege-



FIG. 4.—Carson field or meadow mouse.

tation, they become so excessively numerous as to completely destroy the crops over wide areas. In certain alfalfa fields in the Humboldt Valley in 1907 their numbers were estimated at 12,000 to the acre. Here the alfalfa was completely destroyed, even the roots being eaten. As a consequence, not only was the crop of the year ruined, but also the crop of the following year. The loss was further increased by the expense of plowing and reseeding the land. Moreover, in winter, when other green food is scarce, these mice attack trees and bushes, eating the bark from fruit trees and even large cottonwoods until they are completely girdled and killed.

After field mice have become numerous any method of destroying them is expensive. They can readily be poisoned, but this entails

great expense for poison, materials, and labor. Preventive measures are much less expensive and far more effective.

It should not be forgotten that the enormous increase of the mice is largely due to the destruction of their natural enemies—hawks, owls, gulls, herons, crows, ravens, magpies, shrikes, and such carnivorous mammals as coyotes, foxes, badgers, skunks, and weasels. Many species of snakes also help materially to keep down their numbers. As far as possible these natural enemies should be protected and allowed free access to the fields and open country. Weedy or grassy fence rows and border lines should be closely mowed to give these industrious allies of the farmer every advantage in capturing the mice, and after each cutting of a crop they should be made welcome to the stubble fields.

Meadow mice do not hibernate, but are busy throughout the year, and about equally active during the day and night. Fortunately, however, they do not continue to breed during the winter months, and by energetic measures their numbers can be so reduced before the next breeding season that there will be little danger to the following crop. If undiminished numbers are left over winter to begin breeding in the spring, the crop for that season is doomed.

Directions for poisoning.—Where mice are increasing it may be necessary to resort to summer poisoning with a preparation of strychnine and wheat or barley distributed around the borders of the fields; ^a but the winter, or from November to April, when green food is scarce, is the most effective time of year for destroying them. Piper has found that then they may be poisoned most effectively and economically with a preparation of chopped alfalfa and strychnine prepared as follows:

Dissolve 1 ounce of strychnia sulphate in 2 quarts of hot water, then add 5½ gallons of water. Sprinkle this over 30 pounds of finely chopped alfalfa hay or alfalfa leaves from the bottom of stack or haymow, mixing and stirring thoroughly until the liquid is evenly absorbed by the hay. Place a small pinch, or about a teaspoonful, of this material at the entrance of each occupied burrow.

MUSKRAT.

(*Fiber zibethicus.*)

Muskrats are too well known to need description, for what country boy has not trapped them for the sake of their brown, furry coats, and carried them home by their flattened and naked tails? They are common along the streams and larger ditches and in the marshes and tule swamps of the Carson Sink and Humboldt valleys, as over most parts of North America. They rarely leave the stream banks

^a For preparation of poisoned grain see p. 7.

or water's edge or do serious mischief to crops; but where, as often happens, the banks of irrigation ditches are elevated above the general level, they are a source of considerable danger. Their burrows usually enter the banks a foot or two below the water line and extend for considerable distances, sometimes penetrating the whole width of an embankment and causing expensive breaks and the flooding of adjoining crops. Muskrats are easily trapped, however, and when detected in time they can be caught and the mischief prevented. In ditches with elevated banks permanent traps can be placed at the two ends in such a manner as to impound any muskrat attempting to enter the ditch. These traps should be made of woven-wire netting in the form of a cage, either reaching across the ditch or placed in the middle of the ditch with wings extending to both banks. A funnel-shaped opening with pointed wires sloping inward around the margin of the doorway should be set at the water level on each side of the cage, allowing the animals to enter from either side, but not to return. This is practically the fyke net used for catching fish. If caught when the fur is good, the pelt will pay for the trouble, and when the fur is not marketable the animals can readily be transferred to an inclosed pond or stream until it is of the highest market value. Muskrats may be poisoned along ditch banks by means of strychnine or arsenic in carrots, parsnips, or turnips; but this is an unnecessary waste of a valuable animal; besides the dead bodies pollute the water. There is danger also that the poisoned vegetables placed for them along the banks would float downstream and be eaten by farm animals.

SHORT-TAILED GRASSHOPPER MOUSE.

(*Onychomys brevicaudus*.)

The grasshopper mouse most resembles the common white-footed or deer mouse, but is stouter and more compactly built, with shorter ears and a short, thick, tapering tail. Its feet and under parts are pure white, while the upper parts vary from buffy gray to a pale ashy gray. A full-grown individual measures about 4 inches to the tail, which is only about an inch and a half long.

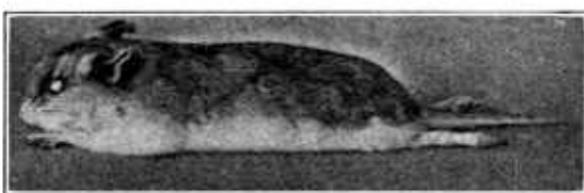


FIG. 5.—Short-tailed grasshopper mouse (one-half life size).

The grasshopper mouse is common throughout the sagebrush valleys of the Great Basin country, but is one of the least known and most rarely seen of the many desert species. It is strictly nocturnal and never comes into or around buildings. At night it prowls among

the desert bushes, capturing grasshoppers, mole crickets, and many other insects, and also scorpions. It occasionally catches and devours other species of mice, and will even turn cannibal and eat its own kind when caught in traps. It also occasionally eats a few seeds, and usually will take rolled oats when used for trap bait. The only practical way to secure specimens of these mice or to get at all acquainted with their habits is by trapping them. At night their presence is often made known by a fine, prolonged whistle, so sharp and shrill as to suggest the sound produced by some insect. Apparently grasshopper mice are never very abundant, but they are so widely distributed that they serve as an effective check on the increase of certain kinds of insects. When captured alive they are usually perfectly tame from the first and make extremely interesting pets. It would doubtless be possible to keep and breed them in confinement and make them of use in ridding gardens or greenhouses of insect pests.

WHITE-FOOTED MICE.

The white-footed mice, deer mice, or wood mice, are abundant, both in species and individuals, over most parts of North America, and especially numerous in the arid region of the western United States. Usually several species occupy the same ground, and one or more adapt themselves to almost every condition of climate and environment. Sometimes they become serious pests, but usually they are so preyed upon by a host of enemies that their numbers are kept within bounds. Besides destroying some grain in fields and stacks, they often enter buildings and do considerable damage, especially in newly settled regions. Most of the species are nocturnal and have somewhat similar habits.

SONORAN WHITE-FOOTED MOUSE.

(*Peromyscus sonoriensis.*)

The Sonoran white-footed or deer mouse is a bright little animal

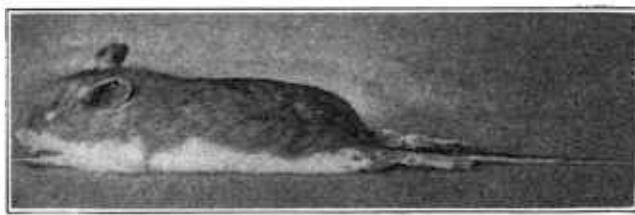


FIG. 6.—Sonoran white-footed mouse (one-half life size).

about $3\frac{1}{2}$ inches long to the tail, which is about $2\frac{1}{2}$ inches. Its feet and under parts are pure white, while the upper parts are clear gray

or light buffy gray. Its large ears and bright black eyes give it a very animated and attractive expression. It is abundant over the whole valley country of the Great Basin and far beyond.

Though strictly nocturnal, these mice are often seen because their homes are in hollow logs, under brush heaps, in hay stacks, under shocks of hay or grain, or in and around buildings. In a new country they frequently enter houses, and sometimes become as troublesome as house mice. They make nests in clothing or blankets stored away in bureaus and boxes, and if a house is left vacant they make their nests in the beds, cutting blankets and mattresses for nesting material. Their usual food consists mainly of small seeds, berries, and a few insects, but they are almost as omnivorous as house mice, and are fond of most provisions which pantry or cellar affords. They are readily poisoned, or they may be caught in small traps, and premises once cleared of them are not soon infested again.

In fields they can be readily destroyed by means of poisoned grain, but great care should be taken to place the poison out of reach of poultry. Around fields and in the open country these mice are constantly preyed upon by many species of owls and hawks, by a number of carnivores, such as coyotes, bobcats, foxes, weasels, badgers, and skunks, and by many kinds of snakes. The only danger of their becoming a serious pest is through the destruction of their natural enemies.

CLIFF MOUSE.

(*Peromyscus crinitus.*)

The cliff mouse differs from the Sonoran white-footed mouse in having a much longer tail and larger ears. Its head and body measure about $3\frac{1}{2}$ inches, the tail $3\frac{3}{4}$ inches. It inhabits rocky places, especially cliffs along rocky canyons. It is not usually found in the open valley and is therefore of little economic importance.

LARGE-EARED MOUSE.

(*Peromyscus truei.*)

The large-eared white-footed mouse is considerably larger than the Sonoran or cliff mouse, measuring about 4 inches to base of tail, the tail $4\frac{1}{2}$ inches. It inhabits canyons and rocky hills along the sides of valleys and rarely comes into the open country.

HARVEST MICE.

The several species of harvest mice inhabiting the arid valleys of the western United States are very similar in appearance and habits. They are among the smallest of our rodents—dull-colored, inconspicuous little mice—and, though often very numerous, are rarely seen.

DESERT HARVEST MOUSE.*(Reithrodontomys megalotis deserti.)*

The desert harvest mouse is a tiny animal about $2\frac{1}{2}$ inches long to the tail, which is about $2\frac{3}{4}$ inches. Its under parts are light gray and the upper parts dull buffy gray; the ears are prominent and thin; but the unmistakable character by which it may be known is the deep groove down the front surface of each upper incisor.

It inhabits fields, dry meadows, and grassy or weedy places generally, but never comes near buildings or makes itself a nuisance. It builds rounded grass nests in the fields under cover of protecting vegetation or under shocks of grain and hay. It is active both day and night. Tiny paths or runways may be traced from one nest to another or from the nests into the fields and over the feeding grounds. The animals feed mainly on small seeds, grain, and a little green vegetation. When in usual numbers they are of no serious consequence, but when, as occasionally happens, they become very abundant the tax which they levy on grain and sprouting seeds means in the aggregate a considerable loss. To attempt by artificial means to destroy a horde of such tiny animals would be like fighting a plague of grasshoppers. But nature has provided numerous enemies, such as hawks and owls, weasels, and other carnivorous mammals, and many snakes, that constantly prey on them by night as well as by day.

HOUSE MOUSE.*(Mus musculus.)*

The house mouse is too well known to need description. The only native species with which it can be confused is the harvest mouse, from which it may be readily distinguished by its larger size and by the plain or ungrooved upper incisors. Although a native of the Old World, it follows civilization so closely that it soon becomes established in any newly settled region. It first invades houses and ranch buildings, but in the mild climate of the Nevada and Utah valleys quickly spreads to the fields, where it becomes a permanent and more or less destructive resident. It usually follows the edges of grain fields, and makes its home in burrows in ditch banks or under weeds along fences. Sometimes house mice become so numerous about fields as to destroy much of the standing grain. They also quickly take up their abode in shocks of grain or in stacks, and if these are left standing for a long time, the quantity of grain eaten and wasted is correspondingly large. The habit of keeping under cover partially protects them from the attacks of hawks, owls, and predaceous mammals, and it is often necessary to destroy them about outbuildings and stacks by artificial means. This can readily

be done by trapping or by scattering poisoned grain in places infested by them, placing the grain in slight excavations under boards or in drainpipes to keep it from larger animals. Where the mice range into the open country and fields, they are preyed upon by natural enemies, and can not be controlled better than by protecting hawks, owls, weasels, badgers, skunks, and snakes.

COMMON OR BROWN RAT.

(*Mus norvegicus.*)

The common rat is an introduced species which follows closely the settlement of a new country and becomes a more or less serious pest according to circumstances. In sparsely settled regions it is rarely very troublesome, but as settlements increase and the land is cultivated more closely, rats thrive and multiply until they become most destructive. At first their mischief is confined to houses, stables, and outbuildings, where the amount of grain, provisions, and poultry destroyed is often considerable, but later they often spread into the fields and destroy crops. The danger from contagious diseases, which are conveyed from port to port and from house to house by rats, is in itself sufficient ground for relentless war upon these filthy and disgusting rodents. In Farmers' Bulletin 297, Methods of Destroying Rats, detailed directions for the destruction of rats and mice will be found. The simplest of these methods is poisoning with a preparation of strychnine and grain or using a trap that kills the rat instantly. One of the best baits is a bit of smoked Vienna sausage. When poisoned grain is used, it should be placed in well concealed situations, such as runways covered with boards, or in tin cans, drainpipes, or some kind of tubing that will admit the rats but no larger animals. For the preparation of poisoned grain see page 7.

WOOD RATS.

Unlike the introduced brown or wharf rats, the wood rats are natives of this country—a product of the wilderness rather than a parasite of civilization. Some species inhabit the mountain slopes, living mainly among rocks; others occupy timbered or brushy areas, and several are restricted to desert valleys. Usually they build conspicuous houses of sticks, stones, bones, and rubbish, either among rocks or brush or in the open, or in some cases in the branches of trees. They rarely enter occupied buildings and have none of the habits of the common brown rat. In areas where they become unusually abundant they sometimes do considerable damage along the edges of grain fields and vegetable gardens, but they are easily poisoned or trapped at their houses or along their conspicuous runways.

DESERT WOOD RAT.*(Neotoma desertorum.)*

The desert wood rat is a native of the arid region and is the only species found in the valleys of western Nevada. It slightly resembles the common brown rat, but is readily distinguished by its smaller size, larger ears, softer, silkier fur, shorter, less naked tail, paler color, and the pure white feet and under parts. It measures about 6 inches to base of tail, which measures about 5 inches.

These wood rats are common over the desert valleys of Nevada, both among rocks and in the open sagebrush country, where they build their own houses and live singly or in families. For houses they heap up a bushel or more of sticks, stones, cow chips, cactus, bones, or other materials which the animals can carry and pile up as a protecting cover for their nests and burrows in the ground beneath. Cactus and thorny branches, if available, are always a conspicuous part of the building material. The house is usually occupied by one old rat, a pair, or a family, but never by a colony. Wood rats are social and visit back and forth from one house to another until well-worn trails often connect the houses and lead to the feeding grounds. The food of these animals is mainly seeds, berries, and many kinds of green foliage. Where the houses are located near the edges of fields, grain, fruits, and vegetables are sometimes eaten or carried away and stored up for food, but fortunately the rats are never sufficiently numerous to do serious damage. Their houses are easily destroyed and the occupants captured by a few minutes' work with a shovel, or the rats can readily be trapped or poisoned. They frequently enter cabins or camps not permanently occupied and eat or carry away provisions. They sometimes cause great annoyance by cutting leather harnesses or saddles. There is rarely more than one animal responsible for the mischief in a camp, however, and a rat trap will usually prevent further trouble. It is unfortunate that the odious name of rat has become attached to these bright and interesting little animals, as otherwise they might become a table delicacy. They are cleanly in habits and are strictly vegetarian in diet. Their flesh is as white and delicate as that of the quail and finer in flavor than that of the squirrel or rabbit.

POCKET GOPHERS.

One or another species of pocket gopher inhabits almost every part of the western United States, some ranging above timber line along the crests of high mountains, others occupying the middle slopes, others the humid areas, and still others the bottoms of the hottest desert valleys. Rarely, however, do more than one species occupy the same ground. All are industrious burrowers, living

mainly underground and throwing up numerous mounds of earth along the lines of their interminable tunnels. They gather and multiply in the more fertile areas, where green vegetation furnishes an abundance of food, and commit ravages on almost every farm crop. Like the meadow mice and ground squirrels, they rank among the most injurious of rodents in agricultural regions where they occur, and every practical method is sought for their destruction. The annual losses to farmers and fruit growers in the United States from the work of pocket gophers have been estimated to aggregate more than \$12,000,000.

NEVADA POCKET GOPHER.

(*Thomomys nevadensis.*)

The Nevada pocket gopher is one of the larger species, measuring about 7 inches to the tail, which is about $3\frac{1}{2}$ inches. Its large fur-lined pockets on each side of the cheeks, long front claws, heavy incisors, small eyes, and inconspicuous ears unmistakably mark the animal. Its tail is slender and almost naked; its soft, glossy fur is of a sandy or pale buffy color above and paler buff or soiled whitish below.

These gophers are abundant in the mellow soil of the valley bottoms, especially in the more fertile parts. They are rarely, if ever, found on the hard, baked soil of the mesa and ridge tops, where a smaller species sometimes takes their place. Where the soil is mellow and food abundant they often become extremely numerous, and their mounds of earth are scattered thickly over the surface of the ground. The animals themselves are rarely seen, as they live almost entirely underground in their interminable burrows, which usually run about a foot below the surface and are extended day by day in search of food. Openings to the surface are made at intervals of a few yards, and the loose earth from the burrows is pushed out in little heaps. After a few quarts, or sometimes a bushel, of earth have been pushed out, the opening is securely closed and packed with earth. Then, as the tunnel is extended, a new opening is made farther along, and another little mound marks the line of progress. Gophers are solitary, more than one rarely if ever occupying a burrow, although from the great number of mounds it is often supposed that they live in colonies. However, in the course of a month a dozen gophers in an alfalfa field will throw up several hundred mounds of earth, which not only cover and destroy much of the crop, but interfere seriously with the mowing machine. At the same time the animals are feeding mainly upon the roots of alfalfa. In many cases the roots are entirely eaten off a plant and the plant killed, while in others they are only partially eaten and the plant more or less injured. Roots are the principal food of gophers, though some green vegetation is eaten. The tunnels are often extended into gardens or fields

where almost every kind of vegetable is eaten, but especially potatoes, beets, and turnips. A gopher will follow a row of potatoes, tunneling from one hill to the next and eating the tubers in each hill. Orchards sometimes suffer even more serious harm. A single gopher has been known to destroy the greater part of the fruit trees in a small orchard by eating off the roots of one tree after another.

The most serious mischief, however, is the destruction of ditch banks. Sometimes the animals are forced out of irrigated land and take up new quarters in the dry ditch banks, or in course of the regular extension of their tunnels a ditch is encountered and the bank is followed in search of a crossing place. In either case the burrow is almost sure sooner or later to penetrate below the water line and start a leak that cuts out the bank and empties the ditch. In small ditches the breaks are annoying in proportion to their frequency, but in larger ditches and canals they are far more serious and in places even dangerous.

No animals are more easily controlled, however, on a small farm or along ditches than gophers. They are readily trapped or poisoned, and once cleared out of a field others do not come in at once. Their mode of travel, which is principally by extending their burrows, is of necessity slow; and if occasionally caught or poisoned around the edge of fields or along ditches, they can be effectually controlled. With the proper kind of trap and with a little experience one can catch a large number in a day by repeatedly visiting and resetting the traps in new places as fast as the gophers are caught. With the best kind of guillotine trap it is necessary only to make a clean opening into the burrow and place the trap in the entrance so that the animal in coming out to close the doorway will push through the loop, press the trigger, and be caught around the neck or just back of the front legs. Gophers have been poisoned very successfully by inserting small crystals of strychnine in raisins, prunes, or potatoes, placing the bait well back in the main burrow, and closing the opening. This method may not prove successful with all kinds of gophers, but it is worth trying, as it is the simplest way of disposing of them. For more detailed instructions for trapping and poisoning gophers see Circular 52 of the Biological Survey.

Gophers subsist on the cleanest and most wholesome of foods and when properly prepared and cooked are excellent food, tender and well flavored.

SAGEBRUSH POCKET GOPHER.

(*Thomomys fisheri*.)

This small grayish brown species inhabits the sage-covered mesas and lower mountain slopes, but rarely if ever comes down into the cultivated valleys. It is readily distinguished from the Nevada gopher

by its smaller size and more brownish color. In some of the foothill valleys it comes into fields, gardens, and orchards, and does considerable mischief, but in the Carson Sink and Humboldt valleys it is of little economic importance.

POCKET MICE.

The pocket mice of the region under consideration may be recognized by their small size, fur-lined cheek pockets, tiny ears, glossy olive-gray or yellowish coats, and pure white feet and under parts. Of the Nevada species the Great Basin pocket mouse (*Perognathus parvus olivaceus*) is a little larger than the house mouse, measuring about 3 inches to the tail, which measures about $3\frac{1}{2}$ inches. The smaller or Nevada pocket mouse (*Perognathus nevadensis*) measures about $2\frac{3}{8}$ inches to base of tail, which is about $2\frac{7}{8}$ inches.

The pocket mice are obscure little animals, never numerous, and rarely seen because strictly nocturnal. They live on small seeds which they gather and carry in the cheek pouches to store in the burrows for food, and though occasionally they take a little grain this is never enough to be missed. They burrow in dry ground, generally under the edge of a sheltering bush or in the side of a bank of mellow soil. Their burrows, however, are not very extensive and only rarely are they a source of danger to the banks of the smaller irrigation ditches. The mice are easily caught in small traps baited with rolled oats and placed at evening near the burrows. Unless as the result of a great reduction in the numbers of mouse-hunting birds and mammals, they will never be a pest or cause for serious alarm on the part of the farmer.

KANGAROO MOUSE.

(*Microdipodops pallidus*.)

The kangaroo mice, or elf mice, like the kangaroo rats, have long feet and legs and large heads, but, like some of the pocket mice, have

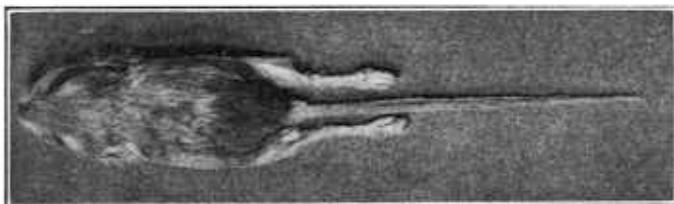


FIG. 7.—Kangaroo mouse (one-half life size).

slender, tapering tails. They have fur-lined cheek pouches, big black eyes, short ears, and silky, sandy gray coats and white under parts. They measure to base of tail about $2\frac{3}{8}$ inches, and the tail about 4 inches.

They are rarely seen alive and comparatively few specimens have ever been trapped. A few have been taken along the eastern edge

of the Carson Sink Valley, and probably they are more generally distributed over the sagebrush deserts than is known. They are nocturnal and live in small burrows similar to those of the pocket mice. Though extremely interesting little animals they are so rare as to be of practically no economic importance.

KANGAROO RATS.

Four species of kangaroo rats inhabit the Carson Sink Valley and some of the neighboring valleys. While not even remotely related to either kangaroos or rats, they have been thus named on account of their long hind legs and tails, small hands, and their method of progressing by hops. They are so similar in general appearance that three of the four species can be distinguished only by careful examination or actual comparison of specimens. One species, the desert kangaroo rat, is readily distinguished by its large size, about twice that of the others, and by the white tip to its tail. The three smaller species are almost identical in colors and markings. They have large heads, short ears, large black eyes, and very long, slender tails. In color they are buffy or yellowish gray above and pure white below, with a white stripe across the hip and along each side of the tail. They can be distinguished as follows:

Hind foot with only 4 toes:

Head and body about 4 inches; tail $5\frac{1}{2}$ inches;
hind foot $1\frac{1}{2}$ inches—

Nevada 4-toed kangaroo rat (*Dipodomys nevadensis*).

Hind foot with 5 toes, the fifth very small:

Head and body about 4 inches; tail $5\frac{1}{2}$ inches;
hind foot $1\frac{1}{2}$ inches—

Columbia 5-toed kangaroo rat (*Perodipus columbianus*).

Head and body nearly 5 inches; tail $6\frac{1}{2}$ inches;
hind foot about $1\frac{5}{8}$ inches—

Great Basin 5-toed kangaroo rat (*Perodipus levipes*).

In habits these three little kangaroo rats are as similar as in general appearance, and they seem to be about equally abundant.

They are common over the drier parts of the valley country, especially in the mellowest and sandiest soil. Their burrows are numerous and extensive, and are usually in the side of some slight elevation or

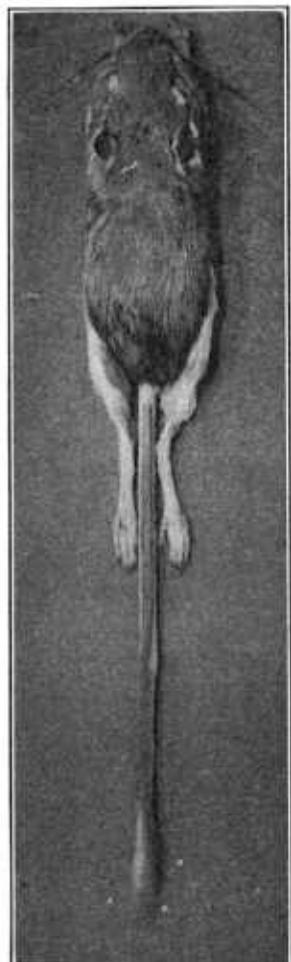


FIG. 8.—Columbia five-toed kangaroo rat (one-half life size).

embankment, where they are carried back on a nearly horizontal plane. Generally there are several openings to a group of burrows, centering in a den or nest chamber and opening out on opposite sides. Often two connected doorways are 10 or 15 feet apart, and approximately on a level with the central nest chamber. These burrows, if in the embankment of a dry ditch, may readily prove an outlet to the water turned into the ditch, and so cause serious breaks. The animals never become excessively numerous, and the amount of grain which they carry away in their cheek pockets is of little consequence. Small native plants furnish them an abundance of seeds, and these, with a little grain from the fields, constitute most of their food. Along ditches, or wherever it is necessary to destroy them, they may be poisoned by scattering a few grains of poisoned wheat or rolled barley near their burrows. Like all kangaroo rats they are strictly nocturnal, and poison should be distributed in the evening after the seed-eating birds have gone to roost.

DESERT KANGAROO RAT.

(*Dipodomys deserti.*)

This large four-toed kangaroo rat differs mainly in size from the three smaller species. It is about 5 inches from tip of nose to base of tail, and the tail is about 8 inches long. Its legs and hind feet are disproportionately long, in striking contrast to the tiny front feet, or hands. The large head, prominent black eyes, and short ears give the animal a quaint appearance. The glossy coat is light sand color over the upper parts and pure white below. The tail is white along the sides and for an inch at the tip. The fur-lined cheek pouches are large enough to admit the tip of the little finger.

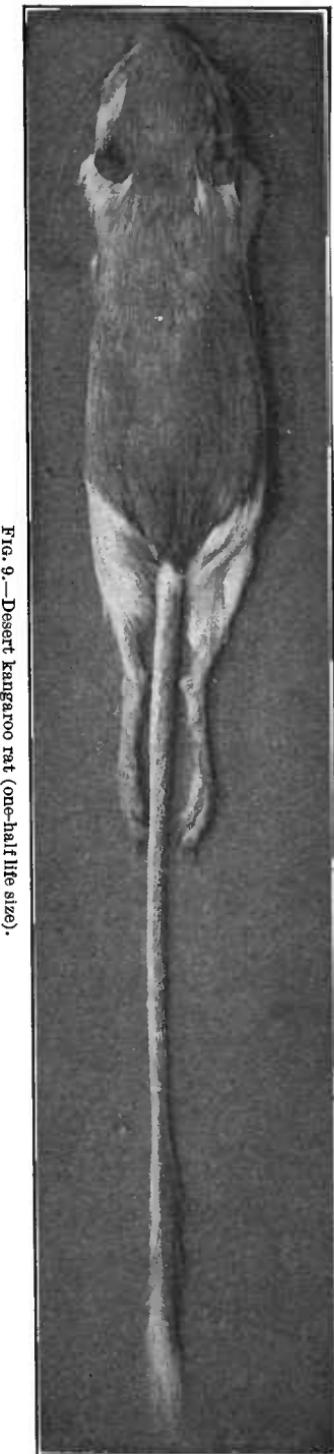


FIG. 9.—Desert kangaroo rat (one-half life size).

These remarkable animals are common among the sand dunes in the bottom of the Carson Sink Valley. They are strictly nocturnal and are rarely seen alive, but their big round burrows are conspicuous, and the paired tracks of their long hind feet may be seen every morning on the naked sands. The tiny front feet are used only as hands and do not figure in the tracks. The manner of traveling is by hops, or long leaps on the hind feet, while the tail serves as a balance and rudder, hence the name of kangaroo rats. In habits they are practically identical with the three smaller species of kangaroo rats occupying the valley, but their larger burrows, often 3 or 4 inches in diameter, are always recognizable. The burrows usually enter the side of a sandy hillock, dune, or embankment, and often extend 10 or 20 feet in a nearly horizontal direction. They do not go deep into the ground, but if started at the base of an embankment they may penetrate through far below the water level and tap the ditches. The partiality of these animals to mellow soil often tempts them to begin burrowing in newly made embankments, but being true desert animals, with a great aversion to water, their mischief is entirely accidental. Their food consists mainly of the small seeds of native desert plants, but also includes a little grain. A part of the food is carried into their burrows for future use. They are never sufficiently abundant to seriously injure crops. Usually on entering the burrow before daylight in the morning they securely close the opening behind them by packing it full of fresh sand, doubtless to keep out snakes, weasels, and other unwelcome intruders. As they rarely come out of their dens until after dark, their presence often remains unknown to people living in the country. They are easily caught in rat traps set near the entrance of the burrows with a little rolled barley or oats scattered over the trigger of the trap. In localities where there is danger of their injuring ditches they can be readily poisoned by scattering a little poisoned grain near their burrows.

RABBITS.

The rabbits of the arid interior of the western United States comprise the black-tailed jack rabbits, the white-tailed jack rabbits, the cottontails, and the brown-tailed pygmy rabbits (*Lepus idahoensis*). Of these the cottontails and the black-tailed jack rabbits are the most abundant and generally distributed in the desert valleys, and the most injurious where they come in contact with growing crops.

BLACK-TAILED JACK RABBIT.

(Lepus deserticola.)

The black-tailed jack rabbit of the valleys is readily distinguished from the large white-tailed jack rabbit of the neighboring mountains. It may be known at all seasons by its very long ears, wholly

black upper surface of the tail, and light gray coat. It is a desert valley animal of wide distribution.

While at home in the desert and at long distances from water, these rabbits prefer the fertile valleys, and often gather in great numbers to feed upon alfalfa, growing grain, melons, vegetables, or young fruit trees. They often become so abundant as to threaten the destruction of crops, and it becomes necessary to destroy them. Rabbit drives have been organized in different parts of the West and great numbers of rabbits surrounded, driven into corrals, and killed. Many thousands have been thus destroyed in a single drive. Except when they are very numerous, however, this method is not practical. Furthermore, it is often important for a farmer to destroy the few rabbits that regularly visit his fields, gardens, or orchards. Sometimes this can be done by shooting, but rabbits may readily be poisoned by means of strychnine in sugar beets, melon rinds, or pieces of apple placed along their runways. The use of poison is always attended with danger, however, and care should be taken to place the poison where no other animals can get at it.

A strong prejudice against eating jack rabbits often exists because occasional individuals are infested by such parasites as the "warble" or "grub" and the tapeworm larva. Unless badly affected, however, the flesh is not injured by these parasites, and there is no good reason why the animals should not be extensively used as food. The half-grown or nearly full-grown young of the year are usually healthy and very good eating when properly cooked. Those not needed for the table may be fed to dogs and poultry. For dogs they should be cooked. The principal natural enemies of jack rabbits are coyotes, foxes, bobcats, hawks, owls, and eagles. When rabbits become abundant these enemies gather to feast on them, and then at least should be afforded protection.

COTTONTAIL.

(*Lepus nuttalli.*)

The cottontail rabbit of the Nevada sage plains is a small light-gray species with moderately long ears. It is easily distinguished from the much smaller, shorter-eared, and almost tailless *Lepus idahoensis* of the higher sagebrush valleys to the east and north.

Cottontails are fairly common throughout the valleys, especially where there is abundant cover of dense sagebrush and greasewood to protect them from their numerous enemies. They are so persecuted by birds of prey and carnivorous mammals that they rarely become sufficiently numerous to do serious mischief. When, as occasionally happens, they do become numerous, they are especially injurious to young orchards. Under the protection of hedgerows and weedy fields, they enter nurseries and orchards and cut off the young trees

or eat the bark from the larger trees. Sometimes in the winter, when green food is scarce, two or three rabbits will almost destroy a small nursery or orchard. Where rabbits can not readily be shot, snared, or trapped, they may be destroyed over limited areas by means of poison. A few small crystals of strychnine should be inserted in pieces of sweet apple or cabbage leaf, and these pieces impaled on stakes 2 or 3 inches above the surface of the ground along the runways. Another method of poisoning, much safer and almost as effective, is to soak the twigs of apple or pear trees in a strychnine solution and scatter them along the rabbit trails. Rabbits may be kept out of an orchard, however, by means of an 18-inch strip of light woven wire along the bottom of any ordinary fence. This wire should cost not more than 15 or 20 cents a rod. When necessary, each tree may be protected by means of an 18-inch strip of woven wire at the bottom or by wrapping with thin wood veneer, paper, or sections of cornstalks. When the orchard is small, these methods are simple and inexpensive. Even were it possible, it is not desirable in any locality to exterminate cottontails. When few in number, they are practically harmless, and they furnish an important article of diet at almost all times of year. Young rabbits are especially delicious.

BOBCAT.

(Lynx baileyi.)

The bobcat, or wild cat, is the only native cat in the valley country. From the Canadian lynx of the high mountains it is readily distinguished by its smaller size, much smaller feet, more spotted coat, and the small size of the black mark on the tip of the tail, which is confined to the upper part of the tip. In the Canada lynx the whole end of the tail is black.

The favorite home of the bobcat is the rocky canyons of the low mountains and foothill country, but individuals frequently wander across the widest desert valleys and are at home anywhere in the sagebrush or thickets along streams. They find abundance of such food as rabbits, ground squirrels, gophers, mice, and woodrats, but they kill sheep also, and sometimes visit the henhouse at night. Except for the destruction of sheep and poultry they may be considered almost entirely beneficial in their relations to agriculture, but occasionally their depredations about ranches are so serious that it is necessary to destroy them. There is no excuse for leaving poultry where accessible to such animals at night; hence the destruction of sheep is the most serious charge against them. Bobcats are readily caught in steel traps baited with rabbits or bits of rabbit fur scattered around a well-concealed trap, or they may be captured by dogs at night. They are not readily poisoned.

DESERT FOX.(*Vulpes macrotis.*)

The desert fox closely resembles the swift or kit fox of the Great Plains region, but has conspicuously larger ears. It is a slender, graceful little animal of a pale yellowish-gray color, with a black tip to its bushy tail. It inhabits the desert valleys to the south, and apparently reaches its northern limit in the Carson Sink Valley, where it is by no means common.

These foxes are so shy and cunning as to be rarely seen in daytime, but at night they often come boldly into camp and help themselves to meat or game left within their reach. Their principal food, however, is kangaroo rats, ground squirrels, gophers, and mice. I have never known them to molest poultry, and consider them mainly beneficial.

COYOTE.(*Canis lestes.*)

Coyotes are the commonest, best known, and most widely distributed of the larger carnivorous animals of the West. They are readily distinguished from dogs, even at a distance, by their erect and pointed ears and drooping tail. Still more unmistakable is their combination bark and howl, a kind of *yap-yap ki-yi-yi-yi-yi*, which once heard is never forgotten. Though natives of the plains and deserts, coyotes thrive in agricultural regions, and show a tendency to increase rather than decrease as the country becomes more thickly settled. They are bold and cunning, defying the ranch dog and prowling at night through pastures and fields and about corrals and barnyards, where they pick up any dead animals left within their reach, or capture unprotected poultry, lambs, or sheep. They are such bold freebooters that they prove a constant annoyance to the farmer, though usually causing him no very serious losses. Their worst crime is the destruction of sheep on the stock ranges, which, in some States, causes a loss amounting to several hundred thousand dollars annually. A small flock of sheep is most easily and economically protected by a coyote-proof fence. The expense for materials for such a fence need not exceed 50 to 75 cents per rod. Full directions for construction are given in Circular 55 of the Biological Survey.^a When farm stock is thus protected the coyote becomes a useful ally of the farmer, as his natural prey consists mainly of rabbits, ground squirrels, gophers, rats, mice, some of the larger insects, and a little fruit. In many cases where rabbits and mice have

^a Directions for the destruction of wolves and coyotes. Circular 55, Bureau Biological Survey, U. S. Department of Agriculture.

become so excessively numerous as to destroy the crops, coyotes have gathered from all sides and proved of great value in destroying these pests. Under such circumstances they should be at least temporarily protected.

SKUNKS.

Skunks are among the most useful of our carnivorous mammals, though often destroyed in the belief that they are injurious. There are two widely different kinds—the large skunks (genus *Mephitis*) and the small spotted skunks (genus *Spilogale*).

LARGE SKUNK.

(*Mephitis major.*)

The large skunk with two white stripes on the back is common throughout the valleys of northern Nevada and Utah, and if protected as it deserves would be far more common. Usually they live within reach of water and follow lake shores and small streams and ditch banks, where mice are most abundant, and make their burrows and breeding dens in thickets or in the sides of gulches. They dig industriously for mice and small rodents, and in this way may occasionally injure ditch banks, but on the whole their work is beneficial. Their food is mainly insects and small rodents, with occasionally a little fruit, and more rarely some unprotected poultry. Grasshoppers, crickets, beetles, and beetle larvæ often make up the main part of their food, but mice, gophers, and small rodents are captured in considerable numbers. At times, when mice become excessively numerous, skunks feast upon them almost exclusively. With a little care the farm poultry can be effectually protected and the skunks left free to carry on their useful occupations. They do not climb, and a 2-foot strip of woven-wire mesh across the bottom of the henhouse door will effectually bar them while allowing the free entrance and exit of the poultry. A still better plan is to inclose the poultry house and yard with a fence that will keep out not only skunks, but foxes, coyotes, badgers, cats, and dogs. Wire netting (1 or $1\frac{1}{2}$ inch mesh), if brought close to the ground and supplemented by a closely barbed wire just under the surface, should prove effective against all of these animals. The fence need not be over $4\frac{1}{2}$ or 5 feet high, unless to keep in fowls that are inclined to fly out.

LITTLE SPOTTED SKUNK.

(*Spilogale saxatilis.*)

The little spotted skunks are about half the size of the common skunk, but instead of two diverging white stripes on the back they

have numerous narrow stripes and spots extending from the neck to the rump. Their weapon of defense is similar to that of other skunks, but their habits differ in many particulars. Spotted skunks are partial to cliffs and rocky canyons, but occasionally wander across the valleys and may be found anywhere in the sagebrush or about fields or along streams. They climb trees readily and are sprightly and weasel-like in their motions. Their food consists largely of mice, though many insects and some fruit and occasionally a bird are eaten. Where rocks and crevices are not available they live in burrows, often in the banks of streams or washed-out gulches. Except when digging after mice and small rodents they are not likely to injure ditch banks and, like other skunks, are almost entirely beneficial.

BADGER.

(*Taxidea americana.*)

Formerly the badger was common over all the desert valleys of Nevada, and might often be seen trotting along the roadside or lumbering hurriedly to take refuge in the nearest burrow. Almost the whole life of the badger is spent in digging out the various rodents that constitute its food. It requires two or three fat ground squirrels a day, or a few gophers and a dozen mice, to keep a badger in good condition. With his long claws and powerful front legs he quickly digs out the burrow of any small rodent, and unless the burrow has a back door the occupant is at his mercy. In case of pocket gophers the badger digs down in several places along the line of the burrow and sometimes succeeds in cornering and capturing the occupant. Mice are easily unearthed, and a nest of young mice is a special delicacy. A few insects are eaten, and on rare occasions a badger gets into a henhouse and makes a meal of poultry. This is the only sin ever laid to his charge, except that his big burrows occasionally cause the fall of a horse and rider. When in pursuit of a gopher, a badger may dig into and endanger ditch banks, but in most cases the gopher, if left alone, would do far more mischief. Practically the only enemy of the badger is man, and it seems incomprehensible that men of intelligence should wantonly destroy on every possible occasion the most useful and least harmful of all our native mammals. So generally, however, are badgers killed that after a valley has been settled for some time they become extremely scarce, and are really in danger of local extermination. As a result one of the most important checks on the increase of ground squirrels, mice, and gophers is removed, and these animals occasionally surprise the farmer by taking his whole crop.

WEASELS.

Weasels are among the most beneficial of carnivorous mammals, as they are too small to do serious harm, and they prey almost exclusively on harmful rodents. A single weasel will effectually keep down the gophers and meadow mice on a field or small ranch. They are never numerous and therefore should be protected with the greatest care.

ARIZONA WEASEL.

(*Putorius arizonensis.*)

This is a rather small weasel, measuring in total length about 9 to 10 inches. In summer it is light-brown above and yellow below, but in winter it usually becomes whitish, or pure white, with only the tip of the tail black.

While never very common, these weasels are occasionally found along streams and ditches or in fields where they actively search for mice and other small rodents. Their scarcity is partly compensated for by their voracity and energy, and they kill every small animal that comes within their reach. They kill far more than they can eat, and seem tireless in pursuit of prey. Their slender form admits them readily to small burrows, where they quickly capture the occupants. They are the most effective enemy of pocket gophers, as they enter the burrows and quickly dispatch the occupants. In a narrow valley where an old weasel had her young I found it impossible to secure a single pocket gopher. Recently made mounds were numerous, but the gophers had been completely exterminated. Occasionally a weasel enters the henhouse and kills chickens, but a few chickens can well be spared in view of the immense benefit the little animals are constantly affording to agriculture. Except in very rare cases they should be protected in every way possible.

MINK.

Mink are rare in the arid regions and mainly restricted to water courses. A few are reported along the Humboldt and Truckee rivers, and they doubtless follow many other streams down into the valleys. They are so rare, however, as to be of little importance either as possible enemies to poultry or as valuable fur-bearing animals. In higher valleys of the mountains they are common.

OTTER.

There are a few otter along the Truckee River, in Pyramid Lake, and along the Humboldt and its branches. They are local or extremely scarce over most of the arid region, however, as the valley streams are few and usually not well supplied with fish.

BATS.

Bats are common almost everywhere within reach of water. Several species inhabit the Carson Sink and Humboldt valleys, some as rare or occasional visitors, others as abundant summer residents. Owing to the nocturnal flight of bats their habits are not well understood, but it is safe to say that all the Nevada species are not only harmless but highly beneficial. They feed entirely on insects caught on the wing. Bats shot in the evening after they have been flying for twenty minutes will usually be found so gorged that it does not seem possible that their stomachs can hold more. If their digestion is as rapid as that of other insectivorous mammals, the number of insects consumed in a night by a single bat must be enormous. The great deposits of bat guano found in caves and under roosting places represent in some cases hundreds of tons of insect remains.